
Rule WLM051: The number of local page data sets may be inadequate

Finding: CPEXpert has determined that the number of local page data sets does not always allow the Auxiliary Storage Manager to accomplish parallel swapping.

Impact: This finding can have a LOW IMPACT, MEDIUM IMPACT, or HIGH IMPACT on performance of your computer system. The level of impact depends upon how many physical swaps to auxiliary storage are done by the SRM and how much the average swap is delayed.

Logic flow: The following rule causes this rule to be invoked:
Rule WLM400: Page-in from auxiliary storage was a major performance problem

Discussion: Swaps to auxiliary storage occur in "swap sets" of 30 page frames if local page data sets are used. The number of pages to be swapped out is divided into these swap sets. For example, if 95 page frames are swapped, there would be 4 swap sets. Three of the swap sets would be 30 page frames and 1 swap set would be 5 frames.

The Auxiliary Storage Manager (ASM) can swap the swap sets concurrently to local page data sets if sufficient local page data sets exist. For example, if there were four swap sets and four local page data sets, the ASM would initiate concurrent swap operations to place a swap set out to each of the local page sets. This process is called "parallel swapping". Parallel swapping allows the actual swap time to be lowered by the number of local page data sets actually used.

Parallel swapping can have a significant reduction in swap-in delay time. This reduction can significantly improve the performance of the address space being swapped in.

Parallel swapping occurs only if swapping is done to auxiliary storage. Thus, if most swaps are logically swapped or are swapped to expanded storage, parallel swapping will have only a modest effect on swap delay time. However, parallel swapping can significantly improve performance when (1) central storage is constrained, (2) expanded storage is unavailable, and (3) swap-in causes a significant delay to a service class period.

CPEXpert analyzes the page/swap configuration when a service class period missed its performance goal and swap-in was a major performance factor for the service class period.

CPEXpert computes the average swap-out size by dividing the number of physical swaps into the number of swap-out pages (SMF71SOT). The average swap-out size is divided by 30 to yield the average number of swap sets. Rule WLM051 is produced if the average number of swap sets is greater than the number of local page data sets.

The following example illustrates the output from Rule WLM051:

RULE WLM051: THE NUMBER OF LOCAL PAGE DATA SETS MAY BE INADEQUATE			
CPEXpert has determined that the number of local page data sets does not always allow the Auxiliary Storage Manager to accomplish parallel swapping. During the following intervals, at least one service class missed its performance objective, and a major cause of delay was waiting for pages or waiting for swap-in to complete. Page delay or swap-in delay can be caused by inefficient parallel swapping. In order to achieve parallel swapping, you should consider allocating more local page data sets.			
MEASUREMENT INTERVAL	AVERAGE SWAP SIZE	LOCAL PAGE DATA SETS ALLOCATED	SUGGESTED ALLOCATION
14:00-14:15, 01MAR1994	111	2	4
14:45-15:00, 01MAR1994	99	2	4

Suggestion: CPEXpert suggests that you consider increasing the number of local page data sets so that parallel swapping can occur. Effective parallel swapping requires that local page data sets be placed onto dedicated packs (or packs with very low activity data sets). Additionally, these packs should be attached to paths which have low utilization.

Please note that CPEXpert will check whether significant migration occurred. If significant migration occurred, CPEXpert will produce Rule WLM059 if the number of local page data sets is insufficient to allow parallel I/O operations for migration of pages from expanded storage to auxiliary storage.

Rule WLM059 may suggest a different number of local page data sets than does Rule WLM051. The reason for this difference is that Rule WLM059 analyzes the number of local page data sets based on the number of pages migrated, while Rule WLM051 analyzes the number of local page data sets based on the average swap size. You should consider the **larger** of the two suggested values.